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January 28, 1987

Walter Axelgard, Commissioner
State Industrial Commission
160 East 300 South
Salt Lake City, Utah 84111

Dear Walt:

Attached you will find the script of a slide tape of a training program which we intend to use to provide annual retraining for personnel who occasionally perform blasting on the surface.

This training will be supervised by our Safety Supervisor, Ben Bringhurst, or one of the surface supervisors. A 5000-23 form will be completed on the trainee to record that the training was given.

The Division of Oil, Gas and Mining regulations require that the annual retraining blasting program be approved by the Industrial Commission.

Would you please review the attached script and, if appropriate, approve our training program.

Sincerely yours,

Glen A. Zumwalt
Vice President-General Manager

GAZ:WWS:lm

Attachment

SLIDE; UTAH FUEL COMPANY

SLIDE: Safe Work Procedure
BLASTING

SLIDE: Prepared by:

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8hrs ?

SLIDE: Picture of Explosives

SCRIPT The purpose of this slide presentation is to assist in training new explosive handlers, retraining experienced ones and to refresh part-time users in the safe handling of explosive materials.

Due to the wide variety and uses of explosive materials, as shown in this slide, this presentation will only address the safety aspects of explosive materials commonly used at this operation. The following areas of explosive safety will be addressed in this presentation:

SLIDE
Storage - Surface
Storage - Underground
Transportation
Handling
Use

SLIDE: (FADING) Storage Surface

SLIDE: Picture of Magazine with Door Open

Federal law prescribes certain types of storage containers called magazines to legally store explosives.
*This is one form of a portable magazine with its heavy steel construction, wood-lined interior and protected double locking door.

SLIDE: Picture of Both Magazines

SCRIPT: Detonator and explosive magazine must be separated by at least 25 feet. The door must be kept closed and locked when unattended.

SLIDE: Grounding (picture)

SLIDE: Sign (picture)

SCRIPT: The magazine must be properly grounded and *signs posted as specified in 30 CFR 77:1301.

SLIDE: Boxes Stacked

SCRIPT: Boxes of explosives must not be stacked over six feet high and care must be taken to see that the oldest explosives are used first. Also, explosives should be stored flat and not on end in order to prevent chemicals within the explosives from migrating to one end.

SLIDE: Filling Out Record

SCRIPT: *To prevent the misuse of this powerful tool, it is necessary to control and account for all explosive materials.

SLIDE: Getting Key

*To obtain explosives, the key must be signed out of the warehouse. A record of explosive use shall be kept in the magazine and appropriate entries must be made. Also, an additional record is kept in the warehouse that must be completed upon returning the key.

SLIDE (FADING): Storage Underground (Pause)

SLIDE: Powder Boxes

SCRIPT: *Explosives used underground must be stored in magazines or powder boxes.

SLIDE: Storage Area

SCRIPT: *These boxes must be stored at least 25 feet from roadways, power wires, and in a dry, well rockdusted location with competent top. The cap and powder boxes must be separated by at least five feet.

SLIDE: Signs (Reflector)

SCRIPT: *Warning signs (reflector type) should be posted to prevent inadvertent damage to explosives. Explosives need also be located at least 50 feet from face and out of the direct line of blast.

The amount of explosives in the mine is limited to the amount that is normally used in a 48-hour period.

SLIDE (FADING): Transportation

*The key point to remember in transporting explosives is to keep caps and powder separated until made up at the face.

SCRIPT: The magazine must be properly grounded and signs posted as specified in 30 CFR 77:1301.

SLIDE: Wheeled Powder Box

*Explosives shall be transported with special care and cannot be transported on occupied mantrips or with flammable or combustible materials. Explosive transport should also not follow or precede mantrips by five minutes.

SCRIPT: Handling (Fading)

Safe handling of explosives requires many tools which we will now review.

SLIDE: Making Hole

SLIDE The powder punch is the most basic of all blasting tools. It is made of non-sparking materials usually brass or wood and is used *for making a hole in the end of an explosive to insert detonator.

SLIDE: Shot Fire Unit

SCRIPT: The shotfire unit is used to detonate the blasting caps which in turn cause explosives to react.

It must be of a permissible type, capable of firing only 20 holes unless otherwise approved by MSHA.

It is important that instructions are read and followed precisely, that batteries are checked, and that the unit is kept clean and dry.

SLIDE: Blasting Galvanometer

SCRIPT: The galvanometer is one of the most important tools needed to insure a safe and productive shot. This is one form of a blasting galvanometer used to check electrical blasting circuits and electric blasting caps. The continuity and resistance of the circuit can be readily checked. The galvanometer uses a special silver chloride battery. In complicated electric blasting circuits, involving numerous electric blasting caps, use of the blasting galvanometers is important to insure that the circuit does not present higher than anticipated resistance to the firing current which could result in misfire.

SLIDE: Galvanometer + X out VOM

SCRIPT: The galvanometer must never be substituted with a standard volt, ohm, milliampmeter because they have been known to supply enough energy to detonate shot.

Use only one specifically designed for blasting.

20 CAPS ?

Kept locked when not used

$E = I \times R$ = 1.5 amps (20 caps × 2.6 ohms + 1.75 ohms) For LF AC

SLIDE: Tamping Stick

SCRIPT: The tamping stick is used to push explosives into the drill hole and also for firmly compacting the explosives into the drill holes. Tamping sticks must be made out of non-sparking materials and are generally made out of wood.

SLIDE: Spoon

SCRIPT: The spoon is used to remove small rocks that might have fallen into the hole during drilling. If rocks are left in the drill hole and get between the sticks of powder, they may affect the shot.

SLIDE: Methanometer

SCRIPT: The methanometer use is required by law. Methane checks need to be performed every 20 minutes while work is being done in the face and it must always be used just prior to a shot!

SLIDE: BLASTING CAPS

SCRIPT: *Blasting caps are inserted in explosive charges to detonate them or set them off. Due to their small size, extremely powerful and sensitive high explosives are used in blasting caps, usually PETN or RDX as the base charge.

The base charge is initiated by other charges within the blasting cap, depending on its type. Instantaneous blasting caps are designed to go off with no delay after they are initiated, while delay blasting caps have a built-in delay which can set them off at intervals of from a few milliseconds to as high as 15.6 seconds later. These delay blasting caps are usually used in mining operations where portions of earth or rock must start to move before other parts of the earth can move. Millisecond — delays are the only allowable delays used in underground coal mining and must be at least #6 in strength.

SLIDE: Diagram of Cap

SCRIPT: This is an interior diagram of an electric blasting cap. Electric blasting caps are set off by an electrical current which heats the bridge wire so that it gets hot enough to initiate the ignition charge which in turn detonates and sets off the base charge. Visualize the bridge wire just like the filament in an electric light bulb. A minimum of 1.25 volts and 1.5 amps will detonate an electric blasting cap.

SLIDE: Tamping Stick

SLIDE: Two Caps #5 and #8

SCRIPT: Electric blasting caps can run from around 2" to 4" in length and are a little over 1/4" in diameter. Copper, aluminum, bronze and brass are all used as shell material. Usually the longer electric blasting caps will be various lengths or periods of delay while the shorter caps are usually instantaneous. The colors of leg wires are of no practical significance in the field, although there are charts available showing the color combinations manufacturers use. These leg wire colors do, however, periodically change. Note in the slide: A #5 and #8 blasting cap that identifies the millisecond delay before going off.

SLIDE: Caps with Shunt Envelope

SCRIPT: Electric blasting caps must be kept shunted at all times until final wiring of shot is carried out. A shunt serves its function of short-circuiting or putting a dead shot across the leg wires and bridge wire. This picture demonstrates a yellow paper envelope type shunt as caps are received from the manufacturer.

SLIDE: Man Making Shunt

SCRIPT: Another form is just the bare end wires twisted together.

SLIDE: Completed Shunt

SCRIPT: Technical experts are in agreement that for practically all purposes an electric blasting cap is far safer when the shunt is in place. This helps protect it against accidental detonation from stray current, static electricity, and electro-magnetic radiation, such as that produced by two-way radio transmitters and lightning. Although it is usually an over-stated worry, it is possible to detonate electric blasting cap with the transmissions from a two-way radio. Charts from an institute of makers of explosives show the various safe distances involved based on actual field tests.

SLIDE: Cap in Can

SCRIPT: To demonstrate the explosive power of an electric blasting cap, one has been detonated inside this can. Note the hundreds of small holes produced by the body of the cap disintegrating in the blast. The bottom of the can is also perforated by holes. It is easy to envision the effect on a hand. Although blasting caps are as safe as the manufacturers can make them, they are still subject

to accidental detonation. – Handle with care

SLIDE: Written Slide

SCRIPT: (Read) Remember, explosives cannot differentiate between initiating energy supplied on purpose or by accident.

EXPLOSIVES – HEAT SHOCK IMPACT OR HARD HANDLING

SLIDE: Different Types (Explosives)

SLIDE: Permissible Explosives (only used in coal)

SCRIPT: Hundreds of types of explosives are available for numerous applications. *In this presentation we will primarily concern ourselves with the safety of what is known as permissible explosives.

SLIDE: Non-Nitroglycerin

SCRIPT: Most permissible explosives are non-nitroglycerin type and may use variations of nitroglycerin compounds which make them safer to handle.

SLIDE:

A permissible explosive carries a label or marking on the case with the brand name and the words "Permissible Explosives." Only explosives with this label can be used in underground coal.

SLIDE: Permissible Explosives (written slide)

SCRIPT: All explosives when fired give a flame which varies in volume, duration and temperature. Black blasting powder gives the longest lasting flame. Some of the dynamites develop a flame which is of shorter duration than that of black powder but which is very much hotter.

Permissible explosives are especially designed to produce a flame of small volume, short duration and low temperature. Therefore, the probability of a gas or dust ignition is reduced.

Permissible explosives, particularly the low and very low velocity grades, absorb moisture readily and deteriorate as a result.

SLIDE: Powder Box

SCRIPT: For this reason storage and rotation of stock

should be carefully supervised. Once permissibles are taken underground, they should be used within a 48-hour period specified in the permissibility regulation.

SLIDE: (Read) A final note on explosives is that all explosives
are dangerous
must be handled with care | You not only kill self by also HELPERS

SLIDE: Head Stones

SCRIPT: Or the consequences may be serious (Pause)

*Stemming * Clay Dummies * Water Dummies

SCRIPT: Another necessary tool of safe blasting is stemming. Stemming is the material which is placed in a drill hole after the charge has been inserted.

Stemming confines the charge and forces the explosion in all directions. Only incombustible materials shall be used for stemming drillholes. Basic Principles

SCRIPT: One type of stemming is clay or rock dust packed in heavy paper.

SLIDE: Water Dummies

SCRIPT: Another form of stemming is called water dummies. Water stemming bags are made of plastic, are often self-sealing and are flexible in order to fit into drill holes. as blast

No shots are permitted to be fired unless they are properly stemmed with incombustible stemming materials or permissible stemming devices. Shooting without any or improper stemming is prohibited by law. Explosives when fired will take the path of least resistance.

Failure to use stemming or an adequate amount of stemming material will cause the shot to blow out and can easily ignite any coal dust or methane in the atmosphere.

- why not discuss resistance increase to misfires leading lines

SLIDE: Shot Wires

SCRIPT: Connecting Wire. Relatively small gauge connecting wire is used for connecting leading lines to the blasting circuit and adds to the total resistance of the leading lines. Connecting wire should be considered expendable since it is generally located in a position where it will be destroyed or damaged by the blast. Efforts to re-use such wire invariably lead to misfires.

Use of Ohmmeter each cap, circuit before cable, cable before [illegible]

Plastic insulated connecting wire is available in copper, aluminum and iron. Copper is preferred and recommended because of its relatively low resistance.

Leading Wire

Leading Lines. Leading lines or leading wires are used to connect the power source to the blasting circuit, usually through short lengths of connecting wire.

SLIDE:

Well insulated single solid wire is recommended. Duplex solid wire is satisfactory for use in small blasts where it must be reeled up between shots. Stranded leading wire is not recommended for firing blasts unless it is mounted in a fixed position on insulated supports. Otherwise, trouble may be caused by breaks in single strands which are difficult to detect inside the insulation. Electrical connectors should always be used to connect stranded wire. Insulated leading wire is available in No. 14 and No. 16 gauge copper, single or duplex type.

SLIDE (FADING): Use of Explosives

Now that we have discussed the material and tools necessary for blasting underground, we will concentrate on the steps for safe use of explosives. (Don't need ste-seers)

Step 1: Safe Work Area (man checking area)

SLIDE:

SCRIPT: Upon reaching the face, a thorough check for methane and roof and rib conditions must be undertaken. All corrections need to be completed before continuing to work.

SLIDE: Cleaning Drill Holes

Step 2: Clean Drill Holes

SCRIPT: Drill holes should be examined for rock or coal or other materials and spooned or flushed clean if present. If water is present in down dip holes, a tamping stick can be used to force water out by rapidly moving the stick in and out of the hole.

SLIDE: Powder Punch in Stick of Powder

Step 3: Make Up Detonators

SCRIPT: (SLIDE) With the use of a powder punch a hole is put in the crimped end of the explosive,

opposite end is normally folded. [illegible] is available in copper, aluminum and iron. Copper is preferred and recommended because of its relatively low resistance

INSPECT CAP FOR INSULATING PLUG OR CRACKS

DON'T USE WITH WATER PRESENT

SLIDE:

SCRIPT: Make sure the hole is in the center and parallel with the outer cover. Make sure the blasting cap cannot be pulled out of the primer cartridge, that the wires of the electric cap are not subject to harmful strains and that the whole primer assembly can be loaded safely, easily and in the preferred position in the charge.

SLIDE:

Well insulated single solid wire is recommended

SCRIPT: The end with the detonator or blasting cap must be placed into the hole first. Never tamp this stick of powder because tamping may damage detonator. *Then other sticks of powder may be placed in the hole and pushed into place by use of tamping stick.

SLIDE: *Detonator leg wires must be held taut and towards the top of the hole to minimize damage.

Tamping. Tamping should be done firmly to insure good compaction. It is usually best to insert not over two cartridges at a time if maximum density is desired and the charge is solidly tamped. However, results and experience in loading will dictate the proper procedures.

This, of course, does not apply to permissibles in shooting coal where compaction is not only undesirable but deformation of the cartridge is prohibited by the Federal Mine Safety Code. These explosives are relatively insensitive and the entire charge, including the primer, should be placed just inside the collars of the hole and pushed back as a unit. This gives a continuous column with all cartridges in close contact.

SLIDE:

SCRIPT: In loading permissibles it is recommended that the primer be the first cartridge placed in the hole with the cap pointing toward the outside or collar. This method is known as indirect priming and offers several advantages. The charge can often be retracted and the hole cleaned if some minor obstruction is encountered in loading. It also assures that the primer will not be pulled away from the charge by tension on the cap wires during stemming.

Step 5. Wiring Face

SCRIPT: There are three methods of wiring up a shot.

SLIDE: Series Blasting Circuit (written and read)

SCRIPT: In the layout of large electrical blasting operations, the type of firing circuit and wiring used can be extremely important. The simplest method is a straight series circuit, which acts to guarantee that each cap will receive sufficient firing current. It is also somewhat simpler to visualize and resistance calculations tend to be simplified.

SLIDE: Circuit

Series Circuits. This type of circuit provides a single path for current through each cap in the circuit. After all the connections are made, the two free ends are connected to the leading lines which, in turn, are connected to the power source. The different colored leg wires may be helpful in avoiding errors in hooking up. For example, in connecting the series, it is a good idea to connect like colors together. In this way a series containing an even number of caps will have free ends that are of the same color and a series with an uneven number of caps will have free ends of a different color. This helps to reduce the possibility of leaving a cap out of the circuit. An advantage of the series circuit is that it can be readily tested with a galvanometer to detect any breaks in the circuit.

SLIDE: Parallel Circuit

SLIDE: Parallel Blasting Circuit (written)

In more advanced blasting operations, a parallel circuit, or one of several variations of it, is used due to its generally lower power requirements. Instead of connecting one blasting cap after the other into the circuit, as in the series circuit, one legwire from each blasting cap is connected to the other side. Parallel circuits are not as easy to work with for the inexperienced blaster and can lead to misfires.

SLIDE: Parallel Circuits.

In the parallel circuit one wire from each cap is connected to one side of the blasting circuit, and the other wire of the cap to the other side of the circuit. The picture illustrates a simple parallel circuit commonly called bunching, in which all the leg wires of one color are grouped together at a common connection and all the legwires of a different color are grouped together at the other connections. In actual practive, the simple parallel circuit illustrated is seldom used because the cap wires are

usually not long enough to reach common points. Thus, it becomes necessary to use one of several other types of parallel arrangements.

SLIDE: Parallel Series Circuits (also called Series in Parallel) (written)

This method is a combination of the two circuits previously described since it consists of joining two or more series of electric blasting caps in parallel. The simplest parallel series circuit contains only two series and is known as a dual series circuit. SHOW FACE WIRED UP) All the caps are connected in a straight series, the two free ends are brought together and, after testing with a blasting galvanometer, they are joined to make a closed-loop circuit. One leading line is connected to any location in the loop, and the second leading line is connected at a point halfway around the loop. The chief advantage of the parallel series circuit is the large number of caps that can be fired without a large power input. For example, in some instances, the dual series circuit can be used to fire up to twice the number of caps that would normally be placed in a straight series.

EACH SERIES SHOULD CONTAIN THE SAME # OF CAPS, + ONE CAP.

SLIDE: Wire Off Face

SLIDE: Holding Wires Straight

SLIDE: Man Looking at Wire Face

Other precautions which need to be taken while wire in a face includes:

SCRIPT: Keeping leg wire from touching face before shot.

SCRIPT: Controlling legwires in a manner to prevent nicks and kinks and rechecking wiring before leaving to shot.

Step 6. Galvanometer Test

SLIDE: Blaster Handbook

The galvanometer tests must then be performed to check continuity and resistance of circuit.

This presentation will not attempt to teach the uses of a galvanometer but will recommend that users consult the Blaster's Handbook for needed information.

Step 7. Connecting Wires

SLIDE: Shunting Wires

Before connecting shot wires, a check must be made to insure all wires are shunted on other end. Galvanometer check should be made before each connection.

OK

Step 8. Barricading Blast Area

SLIDE: Man Standing

Before blasting, a thorough inspection of the blasting area must be made to insure no one is present. Then guards need to be placed at all entrances to area to keep people out.

Make sure all personnel are in safe areas

Step 9. Blasting

SLIDE: Man Hooking Up Shot Box

Make sure you are familiar with the shot box being used and have read directions and followed them completely. Check continuity with galvanometer immediately before connecting shot box. * Yell "fire" three times to warn those in the area and fire off shot.

Step 10. Returning to Blast Area

SLIDE: "Blast"

SCRIPT: Rushing into smoke in an attempt to see the results of a blast is not only unpleasant but actually hazardous since vision is so obscured that dangerous roof conditions may not be seen and also stumbling hazards may exist.

In addition to this, the fumes from a shot of any type of explosive contains toxic ingredients in quantities which may be harmful.

SLIDE: Man Taking CO,NO Tests

SCRIPT: The shotfiring man should check for CO,NO before allowing anyone to re-enter the area. He should also shunt lead wires at face side of blasting cable.

Ventilation then must be restored and a waiting period taken place before moving back into the face area.

Finally, misfire may have occurred at the face and should not be approached until there is no likelihood of an explosion.

SLIDE: Step 11. Misfires

It is well to remember that every misfire is a potential accident and the safest way to handle a misfire is to prevent it by following the proper methods of making up primers, loading, stemming and firing. However, the fact remains that occasionally a misfire is encountered and then the blaster must know first how to handle it safely, and, second, how to prevent its re-occurrence.

Blasters must never lose sight of the fact that working on or near a misfired hole is the most hazardous operation associated with blasting.

SLIDE: Shunting

Where misfires occur, a waiting period of at least five minutes shall elapse before anyone returns to the shot. After such failure, the blasting cable shall be disconnected from the source of power and the battery ends short-circuited before electric connections are examined.

Misfires shall be handled by firing a separate charge at least two feet away from and parallel to the misfired charge or removed by washing the stemming and the charge from the drillhole with water, or by inserting and firing a new primer after the stemming has been washed out.

A very careful search of the working place, and, if necessary, of the coal after it reaches the tipple shall be made after blasting a misfired hole, to recover any undetonated explosive.

SLIDE: SAFETY

Safety is always of the essence at Utah Fuel Company and especially when using explosive materials.

No surface issues